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Article abstract

Atractotomus mali (Meyer-Dür, 1843) (Hemiptera: Miridae) is a zoophytophagous insect associated with orchards in Europe and North America. In Canada, it has previously been reported in apple (*Malus domestica* Borkh) orchards in several provinces, but mainly in Nova Scotia, where it induced more damage on fruit than predatory effects. During the summer of 2014, we collected 33 specimens in an apple orchard in Magog (QC, Canada), using a tapping method. This study constitutes the first record of *A. mali* in Quebec.

First record of the zoophytophagous plant bug *Atractotomus mali* (Hemiptera: Miridae) in Quebec orchards

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Atractotomus mali (Meyer-Dür, 1843) (Hemiptera: Miridae) is a zoophytophagous insect associated with orchards in Europe and North America. In Canada, it has previously been reported in apple (*Malus domestica* Borkh) orchards in several provinces, but mainly in Nova Scotia, where it induced more damage on fruit than predatory effects. During the summer of 2014, we collected 33 specimens in an apple orchard in Magog (QC, Canada), using a tapping method. This study constitutes the first record of *A. mali* in Quebec.

Keywords: apple orchard, mirid, first record.

[Première mention de la punaise zoophytophage *Atractotomus mali* (Hemiptera: Miridae) dans les vergers québécois]

Atractotomus mali (Meyer-Dür, 1843) (Hemiptera: Miridae) est un insecte zoophytophage associé aux vergers en Europe et en Amérique du Nord. Au Canada, il a été rapporté dans les vergers de pommiers (*Malus domestica* Borkh) de plusieurs provinces, mais principalement en Nouvelle-Écosse où il a induit plus de dommage sur les fruits que d'effets de prédation. Durant l'été 2014, nous avons récolté 33 spécimens dans un verger de Magog (Qc, Canada) en utilisant la méthode du battage. Cette étude constitue la première mention d'*Atractotomus mali* au Québec.

Mots clés : verger de pommier, miride, première mention.

The apple brown bug, *Atractotomus mali* (Meyer-Dür, 1843) (Hemiptera: Miridae), is of Eurasian origin and has mainly been reported in Europe (Fauvel 1999; Kondorosy *et al.* 2010). Introduced into North America, it has been reported in eastern and western Canada, namely in Nova Scotia (Knight 1924; Sanford 1964), British Columbia, New Brunswick and Prince Edward Island (Maw *et al.* 2000), and Newfoundland (Wheeler *et al.* 2006). The first record in the US was from Connecticut (Leonard 1965), with known occurrences in eight additional eastern states (Wheeler and Henry 1992; Kain and Kovach 1998). *Atractotomus mali* feeds on several plants belonging to Rosaceae, including apples (*Malus domestica* Borkh), pears (*Pyrus* spp.), peaches (*Prunus persicae* L.), and hawthorns (*Crataegus* spp.) (Leonard 1965; Novak and Achtziger 1995). On apples, nymphs feed on developing fruitlets (size < 2 cm), causing damage that is similar to the one caused by other mirids (Boivin and Stewart 1982). Nymphs puncture the epidermis, and a depression appears at the feeding location. Tissues become callous, thus reducing the market value of the fruit (MacPhee 1976).

Although mirids are mainly phytophagous (Lord 1971), several species are predatory (Lord 1971; Sanford 1964). *Atractotomus mali* is predaceous on mite eggs (Lord 1971; Austreng and Sømme 1980), aphids (Leonard 1965; Sanford 1964), psyllids (Novak and Achtziger 1995; Kain and Kovach 1998; Jerinić-Prodanović and Protić 2013), and on the larvae and pupae of yponomeutid webworms (Wheeler 2001). Feeding on prey is essential for its normal development and survival under laboratory conditions (Jonsson 1987).

In Nova Scotia, *A. mali* was a pest of apple orchards from the 1950s to the 1990s (Patterson 1966; Smith *et al.* 1994). Monitoring and a preventive spray were recommended when the number of individuals reached 10 to 20 per 100 fruits or leaf clusters, with treatment required to reduce or avoid economic damage when populations were more abundant (MacPhee 1976). In the 1990s, 45% of apple orchards in the Annapolis Valley (NS) required insecticide treatment against *A. mali* (Smith *et al.* 1994). Currently, *A. mali* populations vary widely from year to year, and some growers apply treatment while others do not (Suzanne Blatt and Sonia Gaul, pers. comm.).

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During an entomological survey conducted on 11 and 18 June 2014 in an orchard located near Magog (Quebec, Canada, GPS coordinates: 45°12'42"N, 72°8'7"W), we collected mirid nymphs of an unusual species. They were transported to the laboratory, transferred into a 2L container containing fruitlets and apple leaves, and placed in a growth chamber (23°C, 60% R.H., L16:D8 photoperiod) until they became adults. Specimens were kept in 70% ethanol and were sent to the National Service of Identification (Agriculture and Agri-Food Canada, Ottawa, ON) where they were identified as *A. mali*, a new record for Quebec. We then decided to take weekly collections between 18 July and 8 August 2014.

The 0.4 ha orchard block was treated with a biological fungicide (Bioprotect®; 2 June), phosmet (Imidan®; 23 June) and spinosad (GF-120 NF; 1 August). Thirty-five apple trees (Jersey Mac, Vista Bella and Lobo varieties) were monitored at each visit without distinction of variety. Three new grown branches with fruitlets per tree were tapped five times above a sweep net. Fallen *A. mali* were transferred into 15 mL Corning CentriStar™ tubes (Corning, Tewksbury, MA, USA) by buccal vacuuming, and kept in 70% ethanol before identification.

The first nymph collected on 11 June 2014 on an apple (Fig. 1A) was mahogany coloured. Colour may vary depending on the nymphal instar (Sanford 1964). Young nymphs may be confused with other mirids (Jonsson 1985; Leonard 1965; MacPhee 1976; Kain and Kovach 1998), but *A. mali* nymphs are distinguishable by their colour, size, wing pads and antennae. This nymph died in the laboratory. On 18 June 2014, another nymph was collected and molted into an adult male after 9 days. Between 18 July and 8 August 2014, 31 adults were collected (Fig. 1B). No specimens were collected after 1 August 2014. Females were more abundant than males (Table 1). Adults measured ca. 3 mm in length, their body was oval and convex and black or dark red-brown, with

Table 1. Number of *A. mali* collected in a Quebec orchard in 2014.

Date	No. specimens	Sex ratio
	and stage	
11 June	1 N	nd
18 June	1 N	1♂ 0♀
18 July	1 A	1♂ 0♀
25 July	23 A	3♂ 20♀
1 August	7 A	1♂ 6♀
8 August	(-)	(-)
Total	33	5♂ 27♀

N: nymph, A: adult, nd: not determined.

flattened golden or silver pubescence. Adults are often confused with the mirid *Criocoris saliens* (Reuter) (Sanford 1964), but *A. mali* adults are distinguishable by their antennae: the first segment is triangular, dark and much thinner at the base; the second is longer than the first one, dark and strongly thickened, while the third and fourth segments are thin and pale (Fig. 1B).

This constitutes the first report of *A. mali* in Quebec. Only one generation was observed as already reported (Sanford 1964; MacPhee 1976; Austreng and Sømme 1980; Jonsson 1985). In Nova Scotia, *A. mali* belongs to the mirid bug complex, composed of the mullein bug (*Campylomma verbasci* (Meyer)), the red apple bud (*Lygidea mendax* Reuter) and the tarnished plant bug (*Lygus lineolaris* Palisot de Beauvois) (Braun 1991). Other heteropteran species were observed in our orchard, including *Hyaliodes vitripennis* Say, *Phytocoris* spp., and *Ceratocapsus* spp. (data not shown).

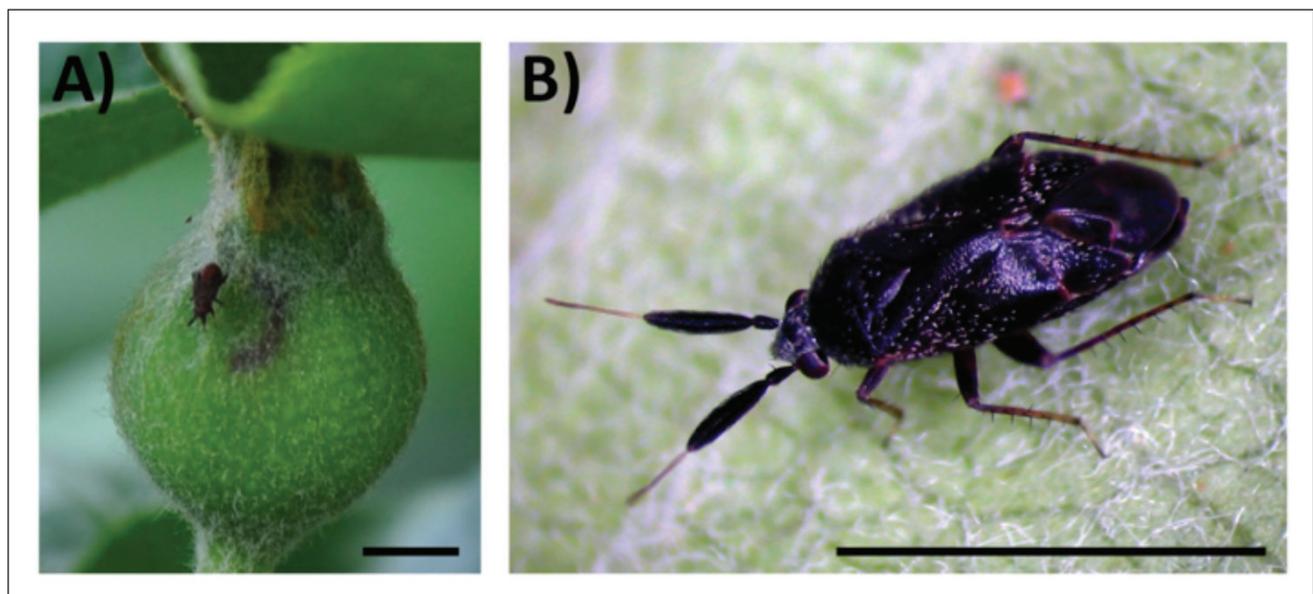


Figure 1. *Atractotomus mali*. (A) Nymph on apple. (B) Adult on apple leaf. Scale bar: 3 mm.

The diversity and abundance of mirids, including the occurrence of *A. mali*, depends on apple varieties (Sanford 1964; Patterson 1966; Kain and Kovach 1998) and fungicide or insecticide treatments done. In the 1950s, in Nova Scotia, growers changed their management practices, using mild fungicides and less insecticide treatments that induced an increase in *A. mali* populations (Patterson 1966; Sanford 1964).

Several factors may have contributed to the extension of *A. mali* distribution: climate change, changes in pesticide use, and commercial exchanges with regions where *A. mali* occurs. In Quebec, its status as pest or predator needs to be clarified, notably by determining its biology and its occurrence in other organic and conventional orchards.

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